Replacement of Bubble Cap Packing with Structured Packing for Solvent Recovery System at Regulatory Area

APL UNIT V

Retrofit of Bubble cap trays with Structural Packing Proposal for Columns DIE001, DIE002 & DIE003.

(16.08.16 TO 23.08.2016)

Technical Details

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Technical Details of Existing Tray Columns

S.No.	Column ID No.	Dia. (mm)	Height (m)	Type of Trays	No. of Segments	No. of Trays	Kettle Capacity & Bundle Area M2	Heat Transfer Area of Primary Condenser, m^2	Heat Transfer Area of Secondary Condenser, m^2	Heat Transfer Area of Product Cooler, m^2
1	**DIE 001**	600	15	Bubble Cap	3	60	6.0KL kettle/50m^2 'U' tube bundle & 20m^2 bottom reboiler	15 m^2 spiral	10 m^2 S/T	8 m^2
2	**DIE 002**	600	15		3	60	5.0 KL kettle & 50 m^2 bottom reboiler	70 m^2 Shell & Tube	10 m^2 S/T	8m^2top & 12m^2 bottom
3	**DIE 003**	600	11		3	48	5.0 KL kettle & 50 m^2 bottom reboiler	50 m^2 Shell & Tube	10 m^2 S/T	8m^2 top & 12m^2 bottom

Process Details

Pre- Treatment details					
S.No	**Column**	**Solvent**	**SRP Batch Size**	**Pre Treatment Process**	**Purpose**
1	DIE001 / DIE002	Ethyl acetate (All Products)	4500	CaCl2 Treatment	To reduce M.C. Below 1.0%
4		Ethyl acetate (Sulbactum Sodium)		Water washing Followed by CaCl2 Treatment to reduce M.C. Below 1.0%.	
5		Acetonitrile		Atmospheric Distillation in reactor and CaCl2 Treatment for Distillate	To reduce M.C. Below 2.0%.
7	DIE003	Isopropyl alcohol	5000	pH Adjustment to 8.0-8.5 with NaOH solution (100 gm in 2 L for 5000 L Input).	For Process Requirement of pH in Production block

Process Details

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Fractions and Main collection rates details

S.No	Column	Solvent	SRP Batch Size (Lit)	Fraction-1 (From Top)					Fraction-2 (From Top till end of main collection from Bottom)			Main Collection (From Bottom)				Residue Qty (Lit)
				R.R.	Dur (Hrs)	Qty (Lit)	Boilup Rate (Lit/ Hr)	Fraction Analysis	R.R.	Dur (Hrs)	Qty (Lit)	R.R.	Dur (Hrs)	Qty (Lit)	Boilup Rate (Lit/ Hr)	
1	DIE001/ DIE002	Ethyl acetate	4500	400: 100 **(4.0)**	3	300	500	EA With Higher M.C. (App 3-5%)	800 : 50	6	250	800: 500 **(1.6)**	6	3000	1350	250 to 300
		Aceto nitrile						ACN With Higher M.C. (App 3-5%)								
2	DIE003	Isopropyl alcohol	5000	-	0	-		NA	-	0	-	600: (800-1000)	6	4200	1500	600

Comparison Details

Comparison of Tray Column Vs. Packed Column				
S.No.	**Parameter**	**Tray Tower**	**Packed Tower**	
1	Surface Area	Less Surface area	**More surface area (500 m2/m3 for 500Y)**	Because of surface area packed column **will get more NTSM witch is useful to get purity in same height.**
2	Gas-Pressure drop	High Pressure Drop	**Smaller Pressure Drop**.	Because of smaller pressure drop **required column height will decrease.**
3	Liquid Hold-Up	High Liquid Holdup	Smaller Liquid Holdup.	It is **important in obtaining sharp separations in batch distillation** columns.
4	Liquid/Gas Ratio	Very low values of this ratio are best handled in tray towers	High Values are best handled in packed towers.	
5	Side Streams	More readily removed.	Can not be removed	Not required for batch Distillation
6	Foaming Systems	Operate with more bubbling of gas through the liquid.	Operate with less bubbling of gas through the liquid.	Packed columns are more suitable.
8	Cleaning	Frequent cleaning is easier.	Cleaning will be done with steaming on campaign basis.	
10	Floor Loading	Lighter than ceramic or metal packed towers	plastic packed towers are lighter in weight than tray towers.	In any event floor loading will be designed for accidental completed filling of the tower and the liquid.

Existing Column Details

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- DIE001, DIE002 & DIE003 Columns was installed on 2002 in Unit- 5. Since then the columns are being used for the recovery of solvents. As these columns are 15 years old it is observed that tray efficiency got greatly reduced due to corrosion of the bubble cap trays, because of which the designed output is not achieved both in respect of quantity as well as quality.

- To achieve the designed capacity w.r.t quantity and quality, it is proposed to retrofit the damaged bubble cap trays with more efficient structural packing.

- As per the new proposal the total boil up is increasing from existing 1350/1500 LPH to ~2700 LPH, it is also proposed to change the Primary condenser from the existing 15 m^2 Spiral condenser to 40+12 m^2 box type condenser.

Cost & Technical Details Comparison

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Technical Specifications and Cost Comparison

S.No.	Parameter	DIE001		DIE002		DIE003	
		Finepac	Fenix	Finepac	Fenix	Finepac	Fenix
1	Packed Height (mm)	10455	11000	10455	11000	7995	8000
2	Packing Type	5.0 L (Equivalent to 500Y)	FXPack	5.0 L (Equivalent to 500Y)	FXPack	5.0 L (Equivalent to 500Y)	FXPack
3	Packing Layer	50 Full & 2 Half Nos.	VTS	50 Full & 2 Half Nos.	VTS	39 Nos	VTS
4	Layer Height (mm)	205	VTS	205	VTS	205	VTS
5	Sheet Thickness of packing (mm)	0.1	VTS	0.1	VTS	0.1	VTS
6	MOC	SS316					
7	Packing Support	3	3	3	3	3	3
8	Liquid Distributors	3	3	3	3	3	3
9	Liquid Collectors	2	2	2	2	2	2
-	**Cost**	**400000**	**685000**	**400000**	**685000**	**350000**	**570000**

Total Cost Comparison in Lakhs	**Finepac Structures**	**Fenix Process Technologies**
	11.5	**19.4**
Installation and Erecting	3	3
Total Project Cost	**14.5**	**22.4**

OI (Return on investment)

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ROI Calculation from different vendors												
APL-5 - SRS Regulatory			Existing (Bubble Cap Tray)		Proposed (Structured Packing)		Job work Price per 1 Kg	Net Savings per month		Finepac		Fenix	
S.No.	Col ID	Solvent	Installed Capacity	Output Capacity	Installed Capacity	Output Capacity				Project Cost	ROI	Project Cost	ROI
			KL/Month		KL/Month		Rs	Rs in Lakhs		Rs	months	Rs	months
1	DIE001	EA/ ACN	208	139	259	173	3	0.92	4.07	14.50	**3.56**	22.40	**5.50**
2	DIE002							0.80					
3	DIE003	IPA	297	250	416	349		2.35					

THAN Q